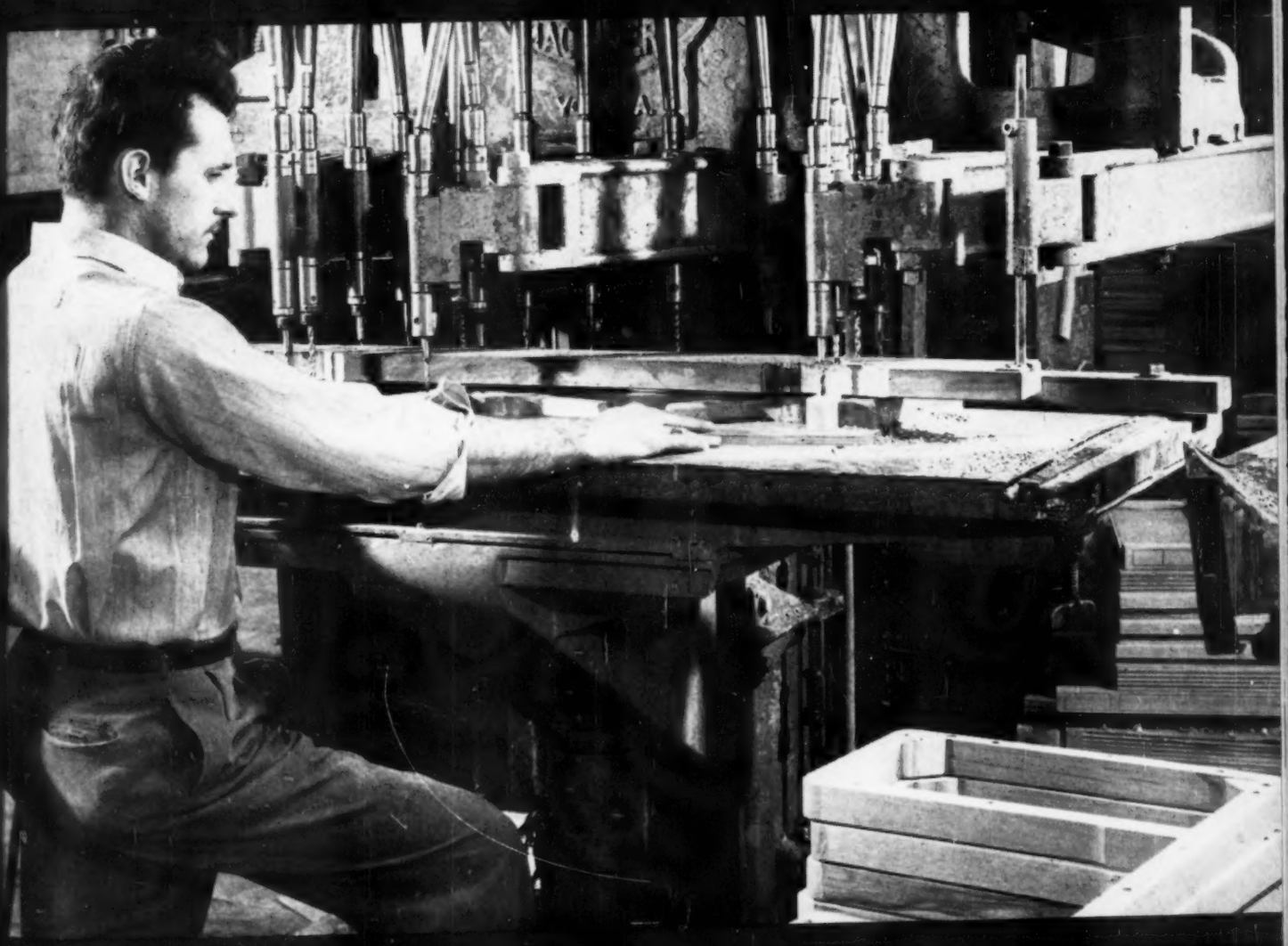
Applied HYDRAULICS



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FRONT COVER: A multiple spindle boring machine, one of a number of hydraulically actuated machines in the woodworking department of White Sewing Machine Corporation, Cleveland. Story on page 12.

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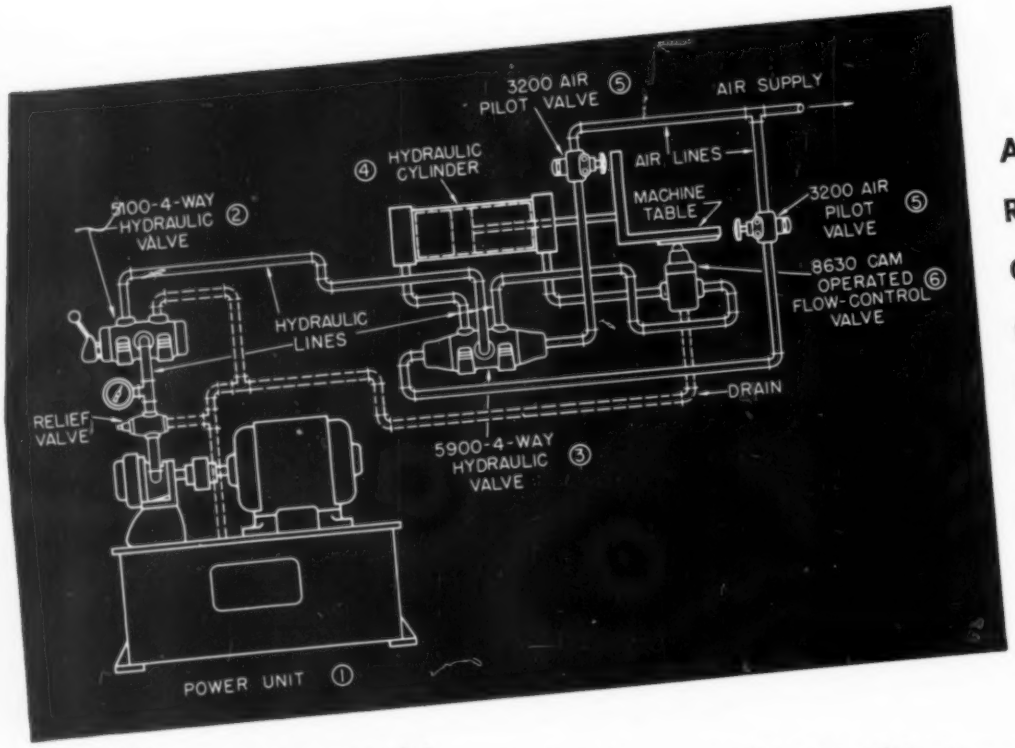

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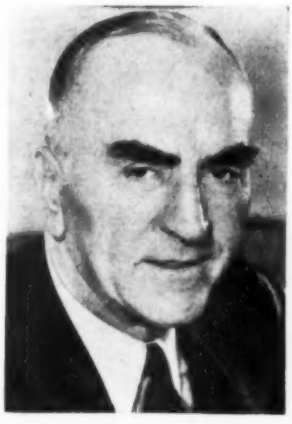
An editorial on Americanism

"GOODS FOR GOODS"

BY CAPTAIN E. V. RICKENBACKER

President and General Manager

Eastern Air Lines, Inc.



CAPITALISM is a steadily shrinking island of Free Enterprise surrounded by turbulent and destructive seas of Monopoly controlled by economic and political dictators.

These monopolies, in which neither producer nor consumer, employer nor employee, determine the scale, standard or cost of living, range all the way from the so-called Socialist system, now in control in England, to enslaving Communism, as practiced in Russia and other Iron Curtain countries.

The whole purpose of business, industry, finance and agriculture is to produce at costs that provide the greatest volume of goods for the greatest number of people.

Men can fill libraries with books on economics, monetary systems, political sciences and social reforms. I will not say that this is a waste of time, but I do claim that all the codes which govern and concern the comfort of man can be compressed into these three words: GOODS FOR GOODS!

The sooner the world re-establishes this simple fact, the sooner we will return to an even keel of political, mental and economic security.

There is no wealth of any kind outside of products in services and goods. The only riches which enable us to eat and drink, or clothe, shelter and educate ourselves and our families are the riches that are made through the skills of man in industry or grown through the skills of man on farms.

No government can wave a magic wand and provide things for people who do not produce. No social code, no political vote-bait, no creed can meet the needs of of those who do not produce. "GOODS FOR GOODS" is the controlling law. It cannot be amended nor repealed.

Production, not money, is the master of the world. And I, for one, have never been able to understand why a system such as America's unbeatable policy of productive and shared Free Enterprise needs so much explanation, so much underscoring, so much selling. Free Enterprise should sell itself every day in the world-wide news you read in newspapers, hear on the radio or see on the newsscreen.

Capitalism has become a highly misinterpreted word. Capitalism, in the true productive sense, is not a banker under a top-hat, a "boss" in a limousine or a stockholder on a yacht. Capitalism is a structure of production. I invite anyone to show where the state-ownership of Socialism or mass-enslavement of Communism have provided so much for so many in any land on earth as has Capitalism in America.

We in America are free to work where we want to work; free to work at the type of work we want; free to live where we want to live. Try to do that in Russia, and *you land in jail.*

It would be wonderful if we were taught in school that Time is worth more than money—not that hours are only dollars, and that minutes are only cents.

If that were the case, I firmly believe we would be less wasteful with our most productive possession—TIME! Time to produce. Time to rest and play. Time to improve ourselves, and Time to establish on earth the Realm of Brotherhood that God created.

HYDRAULIC PACKING AND SEALS

By CARL E. SCHMITZ

PART I

A survey of the compression and self-sealing types of packings, including new materials, available for hydraulic applications. The author emphasizes the importance of consulting the packings manufacturer before finalizing of equipment design and points out that a wide range of types and combinations of packings are available to meet practically any operating conditions of speed, pressure, temperature and nature of the fluid handled.

PIONEER DEVELOPERS OF HYdraulic devices were faced with the problem of holding the system fluid at the point at which the piston contacted the cylinder wall or the shaft passed through the gland and the stuffing box. Considerable research was devoted to the choice of proper materials for satisfactorily confining the liquid pumped or handled. Early in the development, such materials as cotton, hemp, flax, rags and other similar materials were used. This paper describes the general basic types of mechanical packings.

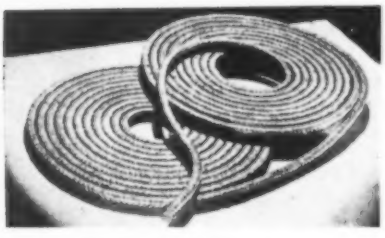


Fig. 1. Square braided asbestos packing for general service use.

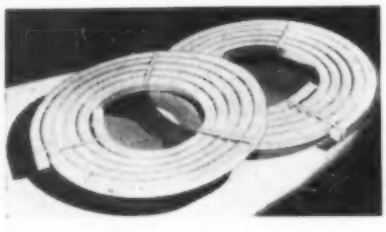


Fig. 2. A typical "hydraulic tucks" packing.

The basic types will be treated in two general groups: (1) compression types of packings; and (2) the so-called self-sealing types of packings.

The Compression Types

Perhaps the earliest form of commercial packings were the braided forms of asbestos or similar materials, impregnated with lubricants to prevent abrasion of the shaft or cylinder. This form, which is still in use as a general service packing, can be used on reciprocating rods or rotating shafts. Service limitations are normally 450 linear fpm on reciprocating rods and 3600 rpm for rotating shafts and at temperatures up to 300 F. While materials used include cotton yarn, flax, ramie, hemp, glass, rayon, nylon and other materials, asbestos is the most generally used.

Within the last year a new material, Polytetrafluoroethylene, known by its trade name "Teflon", has come into acceptance in this type of packing. "Teflon" is resistant to practically any chemical, except perhaps molten alkali materials. It has high temperature resistance (temperatures to 450 F) and is finding wide application in the general chemical processing industry, in paper mills and other applications where the packing corrosion problem is severe. Further, "Teflon" possesses a low coefficient of friction at slow speeds, making it suitable for use in valve stems, diaphragm valves and other types of equipment where freedom of movement is an important consideration.

Another rather recent development, Polymomochlorotrifluoroethylene, or "Kel F", displays remarkable resistance to most corrosive chemicals. It has many desirable characteristics which promise to make it outstanding as a packing material.

An important development for high pressure use was the type of packing built up of woven asbestos cloth, folded or lapped about itself, vulcanized and lubricated with a liquid lubricant and graphite. This type was widely used for steam and air service, principally for reciprocating rods before the centrifugal or rotating type equipment came into common use. A great many plants still operate reciprocating pumps and these packings are widely used in that general service.

Because these packings left much to be desired, especially

in piston service in reciprocating pumps, the familiar "hydraulic tucks" type was devised (Figure 2). These packings were fabricated by laminating fine cotton cloth with rubber and curing to the desired hardness, which varied from medium hardness to rock hardness. This type was widely used in packing hydraulic pistons for many years. Common practice in installing these packings involved extremely high preloads. They are still in use in many medium size power plants on reciprocating pumps in general liquid service at temperatures to 250 F.

Machined types of metallic packings which had given splendid service on reciprocating marine engines, suggested the possibility that a flexible metallic packing could be adapted to pumps with equal efficiency.

Various types of flexible metallic packings were made; one early type being composed of lubricated metallic foil wound around a strong core and squared to the desired size. A practical development of this type is shown in Figure 3. These packings are made up of long lengths of wide foil, lubricated, spirally and loosely wrapped, crinkled and folded, and finally squared to size. The wrinkles trap multitudes of small reservoirs of the lubricant within the structure of the packing.

Various types of flexible metallic packings are in use today, primarily on centrifugal pumps and rotating shafts over a wide range of speeds and for temperatures up to 900 F. They are frequently used in combination with other types of packing sets. Metals commonly used include lead, copper, nickel and aluminum.

Solid, all metal types of packings sometimes lacked the desired resilience for adequate sealing under conditions of vibration and misalignment. Also, since packings are sold on a pound basis, economic factors played a part in the development of still newer types of packings.

The new types, which illustrate the trend of this development, employ a fibrous or plastic core and a metallic foil jacket. These types are widely used, either as a full set or in combination with all-metallic and plastic packings.

A similar development, combining metallic and fibrous packing, is used for reciprocating rod service. Built up as described for flexible metallic packings, they are covered with a channel of woven, rubberized cloth of heavy duck or asbestos, which is stitched to the metallic insert. These packings are good for temperatures up to 450 F. An important design advantage is that the lips of the channel act as individual small wiper rings. By the use of braided copper wire metal sections, some forms of this type can be used for temperatures as high as 850 F.

So-called plastic packings originally were compounded of asbestos fibres, metal particles, graphite and a grease or oil lubricant extruded into a widely spaced cotton jacket to hold the group together. Because this type tended to lose its lubricant too easily, a subsequent development to correct this fault was logical. Utilizing substantially the same materials and compounded with a vulcanized binder to hold the distribution of graphite evenly throughout the structure, this type, Figure 4, is in wide use for centrifugal and rotary pump shafts.

Plastic packings are frequently used in combination with flexible metallic "bull" rings when high pressure or large land and throat clearances are encountered. Available without a protective asbestos jacket for temperatures to 700 F, they can be used up to 900 F and at high pressures with an asbestos jacket of very high grade asbestos yarn or yarn inserted with monel wire.

The plastic jacketed type of packings are dry lubricated with either graphite or mica. Mica is used for service conditions in which graphite corrodes certain types of steels when the equipment is inoperative.

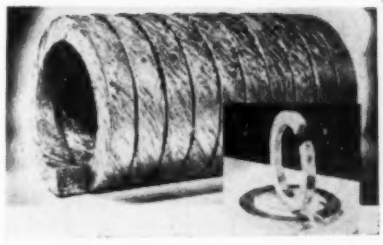


Fig. 3. A typical flexible metallic packing.

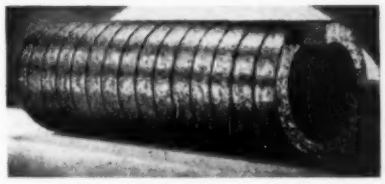


Fig. 4. A typical dry-graphitized plastic packing, widely used for centrifugal and rotary pump shafts.

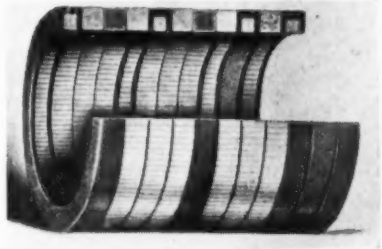


Fig. 5. A combination packing set for a reciprocating oil pump.

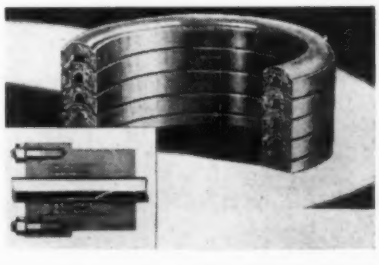


Fig. 6. An asbestos and rubber "V" packing and typical application.

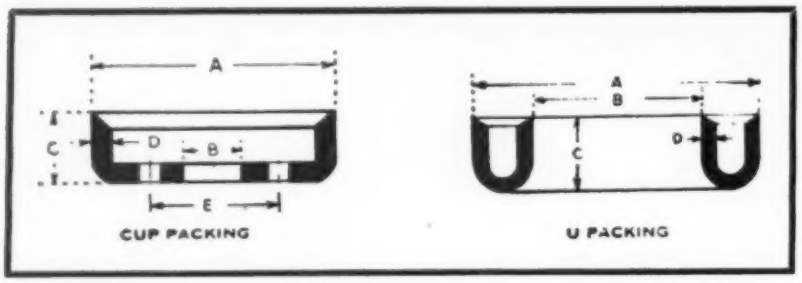


Fig. 7. Leather cup and "U" packings.

The properly packed stuffing box has long been a serious problem for the manufacturer and the user. The present trend is to go to the packing manufacturer who produces or will produce packing sets or combinations of packings which will give the best service and the longest life for a given set of operating conditions.

Such combination sets, an example of which is shown in Figure 5, are built up of rings which are die-formed to exact stuffing box sizes. The die-forming operation consumes much of the initial compression that would be experienced with a non die-formed ring—resulting in simpler installation, minimizing the stocking problem and giving the user the advantage of the packing manufacturer's experience.

Sets of endless metallic rings are becoming increasingly popular for small pumps, valves and similar equipment where the endless ring may be slipped over the shaft or rod to be sealed.

Endless plastic rings are almost universally used on valves and similar equipment where the application can be made by merely dropping the ring over the end of the shaft or spindle. These packings have the advantage of being preformed to size and shape; considerable economies are effected in initial installation and when replacements are necessary.

The Self-Sealing Types

The early development of packings for high pressure hydraulic service, or packings that would seal without gland compression, were the so-called "U" and "cup" packings, shown in Figure 7. Made primarily of leather tanned to suit specific operating conditions, such packings are good for relatively high pressures but are limited to temperature applications of approximately 180 F.

"V" packings were the next development. A typical "V" packing and installation is shown in Figure 6. Various materials, particularly laminated duck and rubber or asbestos and rubber, are used. Once installed, these packings do not require gland adjustment, are satisfactory for relatively high pressure, can be compounded to withstand the action of practically any liquid and types have been produced to withstand temperatures as high as 700 F. Developed primarily for reciprocating rods and pistons, this type is also being used on rotating shafts where peripheral speeds do not exceed 450 to 500 fpm.

The homogeneous synthetic rubber "V" rings were a logical development. Such rings are economical to make and permit the installation of a greater number of rings in stuffing boxes of limited length. These rings do require finer surface finishes however, and usually take metallic top and bottom adaptor rings. In some cases the proper contour can be machined into the bottom of the box and the gland nose.

The next development was the familiar "O" ring. Figure 8 shows a typical application. These rings are available in a wide range of synthetic rubber compounds to withstand a wide variety of liquids; some progress has been made to increase the temperature resistance. "O" rings are widely used for dynamic sealing which requires exceptionally close limits. Air Force requirements have been a primary factor in this development.

"O" rings are also used as static packing or seals. Used originally for static or dynamic sealing in hydraulic cylinders, experimentation has shown that "O" rings can be applied to advantage to welding guns, paint spray guns, hose connectors, valves and a host of mechanical appliances. As yet they have not proved themselves where high rotating speeds are involved, but the economy and ease of installation make them extremely popular for those applications on which they can be used.

Packing Problems

There are several important factors concerning packings to which we wish to call your attention:

(1) *Angularity.* It was formerly believed that angularity of the stuffing box and the nose of the gland was important and necessary. Relatively recent investigation and modern trends

(Continued on page 18)

Fig. 8. A typical "O" ring application to hydraulic piston gland and gland seat.

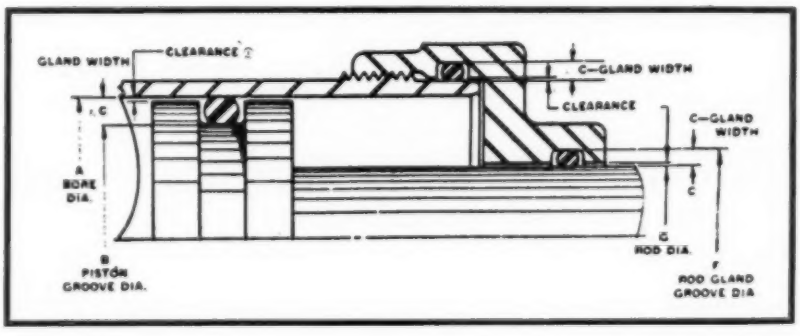


Fig. 1. A vertical boring machine with hydraulically operated table set up to drill 17 holes simultaneously. The group of irregularly spaced holes are visible in the finished pieces, lower right.

WOODWORKING GOES MODERN

The woodworking shop of a leading manufacturer of sewing machines has, by the use of hydraulically actuated boring and shaping machines and multiple platen presses and by the use of air for operating routing machines and auxiliary operations, reduced unit operating time, improved shop housekeeping and material handling and increased the job flexibility required by high speed production.

ONE OF THE MOST MODERN woodworking shops in the Cleveland area is a department of one of the oldest manufacturing plants. The White Sewing Machine Corporation woodworking shops are replete with power driven, multiple operation, automatic equipment that easily holds its own with other departments of the company in the production of a record making number of units completed daily. The number of hydraulic and air power applications has kept steady pace with the increased production requirements; they have materially aided in the reduction of unit costs, reduced the element of human error and make the woodworking shops neater, roomier and a more pleasant place to work.

Practically every operation has been mechanized in the woodworking shops at the White Sewing Machine Corporation. Rough cut and finish trim, sanding and flat surfacing, the preparation and pressing of plywood, routing and drilling or boring operations are all done on modern equipment, some of which was specially designed and built for White.

Because the fine cabinets which house the sewing machine

mechanisms are made entirely in this company's woodworking shops, the boring and routing operations are important. A large number of holes are bored for each complete cabinet assembly.

Prior to the war, the boring was done almost entirely on single vertical spindle machines. This made the boring a slow, costly operation and it required the attention of a skilled operator to hold the irregular center-to-center tolerances required for good assembly fitting.

As soon after the war as the delivery permitted, a multiple spindle vertical boring machine with hydraulic feed for automatic continuous or intermittent table strokes, was purchased and put into operation.

All the production operations in the White shops are established by consultation with the department heads, engineers and time study department. The woodworking department occupies a relatively large area, with provision for considerable machine-side and adjacent stock storage.

The principal advantage of the hydraulic feed boring machines have been increased production, uniformity and exact positioning of holes, practical elimination of rejects and cleaner, safer operation.

Instead of boring a single hole, as before, up to 17 vertical holes are bored at one time, in practically any position over the work table and in a range of sizes and heights above the loading and unloading position of the table. The hydraulic system raises and lowers the table bringing the work to and retracting it away from the boring tools.

The job illustrated, Figure 1, shows a typical vertical boring machine set up to drill 17 holes in a preformed flat wood assembly, the holes being irregularly spaced. The set up time varies according to the job. The set up man works, appropriately enough, from a diagram traced on a wood pattern.

The hydraulic system in the vertical, multiple-spindle borer is essentially a double acting cylinder, whose piston raises and lowers the boring table and is controlled by an automatic-acting main control valve. This valve is provided with a feed rate selector arm to secure any table feed rate from 10 to 120 in per minute. In terms of feed strokes, this means 2 to 35 table strokes per minute depending on the length of the feed stroke. All controls, except the feed rate selection, are by foot operated levers, four in number. From a standing position facing the machine table, the operator can start, stop, raise or lower the table motion. The table may be started, stopped or reversed at any point of the feed or return stroke. An automatic safety valve is preset to open and stop the table whenever the table is stalled due to overload, dull bits or any other reason. (See Figure 2).

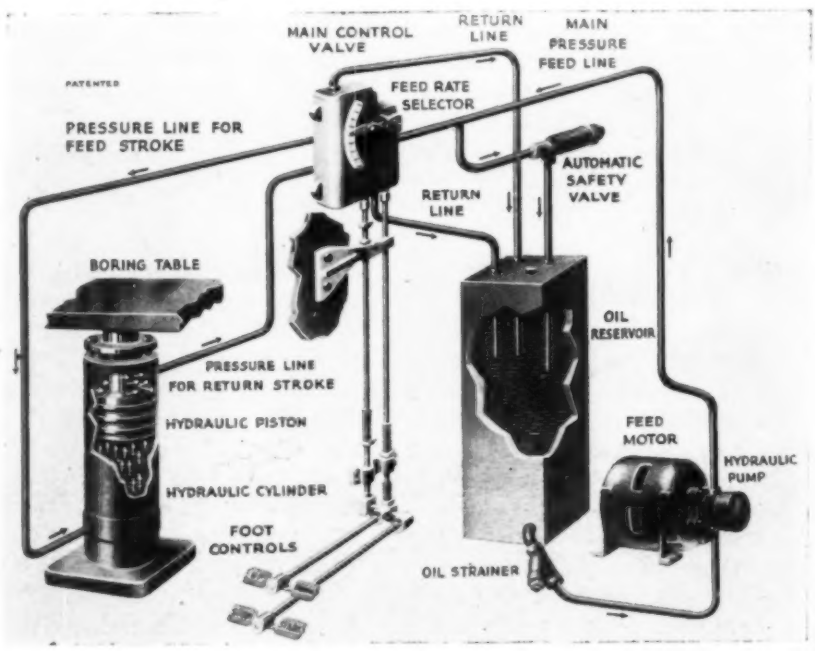
According to Carl J. Lerch, woodwork engineer, the multiple spindle boring machine has been in operation approximately three years and has equalled the output of several machines previously used. Department plans call for a second similar machine to simplify the boring problems as production requirements are increased.

The woodwork department also has two horizontal multiple borers in operation. The same basic principle is used except that the cylinder and piston are horizontal. Hydraulically operated vertical clamps are synchronized with the feed strokes so that the clamps open and close just before and after the bits enter and leave the stock. The spindle motors are mounted on the rear of the machine at staggered intervals so that practically any combination of boring positions can be set up. These machines are used for face boring operations of partially assembled frames as well as all types of edge and end boring.

On long pieces of stock the entire machine bed may be used. On short pieces, identical or different set ups may be made and two operators used. This gives considerable flexibility and levels out production requirements.

The hydraulic clamps are operated by a clamp cylinder (see Figure 3), whose piston operates a toggle to lock and unlock the stock clamp. Flexible hose connections to and from the control valve supplies the

Fig. 2. The hydraulic circuit for operation of the vertical spindle borer table.



fluid pressure to actuate the clamp cylinder.

Both the vertical and horizontal borers are equipped with air blowers for chip removal. The chip blower is automatic in action, the air blast clears the chips after each boring stroke. An air saver valve and air valve adjusting rod, set and positioned when the boring bits are set up for each job, conserve the volume of air used and apply it at the exact position required.

Hydraulic maintenance on both the vertical and horizontal borers has been comparatively negligible over a period of two to three years. Aside from the makeup oil and the outside cleaning of exposed parts, a regular part of the housekeeping in the shops, there has been practically no service maintenance. The plant maintenance department is trained to take care of any normal maintenance service.

The rather large plywood requirements are met by a hydraul multiple platen press.

Mechanically operated shaping machines, two and four station, and employing hydraulic clamps, are also used in the woodworking shops. The hand valve release, hydraulic clamps have made it possible for these machines to be operated by one man. These machines have considerably increased production per worker in each case.

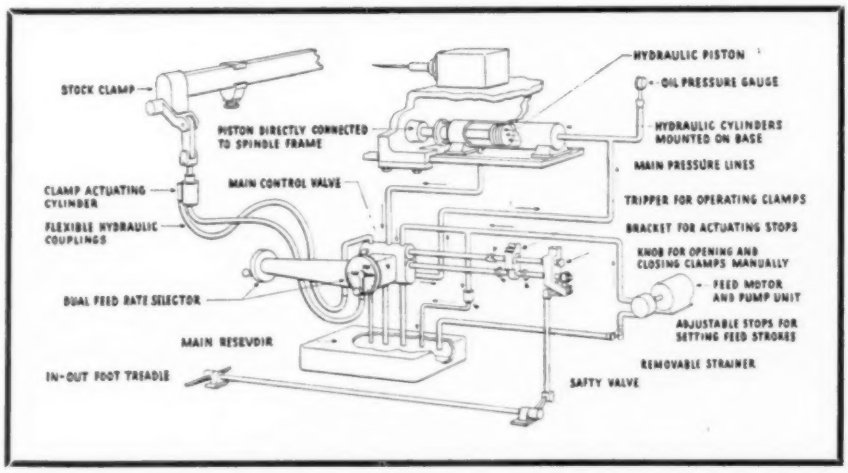
Some of the routing machines are specially designed and are operated by an air motor, with air cylinder clamps. Most of these are small, high speed machines that do single bit cutter operations. One single bit router set up on an index table, operates at 20,000 rpm. The finish and center-to-center tolerances are close enough for the most exacting specifications, in spite of the high speed.

Air is supplied by a central station system. Three years ago two compressors which supplied 1000 cfm for the entire plant were sufficient; today compressors with a capacity of 2100 cfm are used for both woodwork and metal operations.

The increased production with the new borers, shapers and routers has decreased the number of machines in the overall woodworking operations. The additional space has been utilized for the larger machine-side stocks required, so that the increased production is being handled in the same floor space. The increased specialization of jobs has increased, rather that decreased, the pride of craftsmanship of the workmen.

The White Sewing Machine Corporation has, by the use of hydraulically operated borers and shapers, the use of standard and special routing machines operated by air, by hydraulic platen presses and the well planned use of air for auxiliary operations, modernized its woodworking department to keep pace with advances in other departments in the plant. The increased use of modern equipment has increased production, reduced unit operating time and has been an important factor in keeping this company in its long established position among the leaders in its field.

Fig. 3. Diagram of the horizontal machine hydraulic circuit.



Changes in Hydraulic Standards

Since the first publication of the JIC Hydraulic Standards for Industrial Equipment, there have been three corrections made as follows: (1) in section H2.4, Controls, Circuit, sentence (B) of paragraph H2.4.7 which reads, "Positive safety stops for machine slides shall be adjustable, but shall have provision for replacement" was corrected to read, "Positive safety stops for machine slides shall not be adjustable, but shall have provision for replacement"; (2) On page G of the "Glossary of Terms", the definition of "Back Connected", which reads, "Where piping connections are on normally exposed surfaces of hydraulic components" was corrected to read, "Where piping connections are on normally unexposed surfaces of hydraulic components"; and (3) the definition of "Restriction Choke (Fixed Viscous)" on page J of the same section which read, "A non-adjustable resistor in which the pressure drop rate of flow is not entirely independent of viscosity" was corrected to read, "A non-adjustable resistor in which the pressure drop or rate of flow is not entirely independent of viscosity."

Until such time as copies of JIC Hydraulic Standards for Industrial Equipment are available from the cooperating groups (listed on page 16, December issue, APPLIED HYDRAULICS), copies may be obtained from General Motors Corporation, Production Engineering Section, 15-228 General Motors Bldg., Detroit 2, Mich., attention Mr. J. C. Rauss.

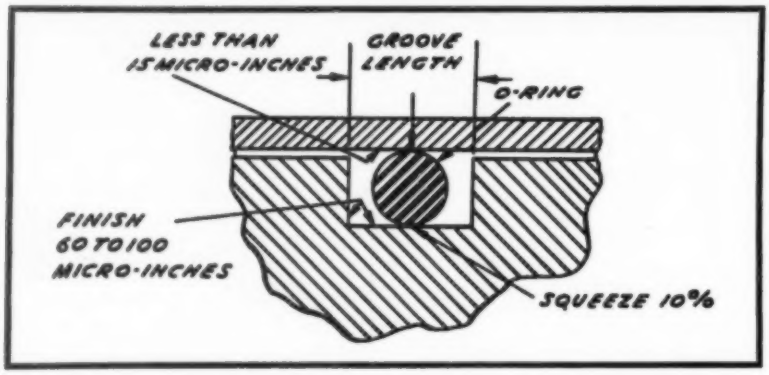


Fig. 1. A cross section of a standard or long groove, the length of which is approximately one and one-half times the "O" ring cross section.

HOW TO ELIMINATE THE PROBLEM OF "O" RING LEAKAGE

By TOMMY J. McCUISTION

Practical pointers on the leakage problems encountered in the application and installation of "O" rings and remedies for their control or elimination.

ON RECIPROCATING MECHANisms "O" rings normally allow only a few drops of fluid leakage per thousand cycles of operation. While this is not of importance on many units, some designs can tolerate practically no leakage of the fluid or gas. By the use of "O" rings as seals, units can be made to operate with virtually no leakage; however, this usually is achieved by reducing the seal life or by increasing the unit cost.

"O" rings used as static seals occasionally leak. Normally, this is easily corrected by a change of groove design. In many cases static seal leakage can also be prevented by using a harder "O" ring compound, by increasing the squeeze or by increasing the metal surface roughness.

The Army and Navy and "O" ring manufacturers have more or less standardized recommendations for gland designs. However, some concessions had to be made to cover the widest possible range of applications and operating conditions. As shown in Figure 1, the recommended groove length is normally about one and one-half times the "O" ring cross section. This relatively long groove allows the seal to roll back and forth as the unit is reciprocated. In this way wear is distributed over about 100 degrees of the "O" ring cross sectional arc. Consequently, the life of the seal is almost double what it would be if it were confined in a shorter groove.

Rod type seals, where the pressure acts in one direction only, naturally do not tend to roll as much as the piston type. Some rolling does seem to occur; however, this is attributed to the friction of the rod and the variations of the pressure.

(Continued on page 20)

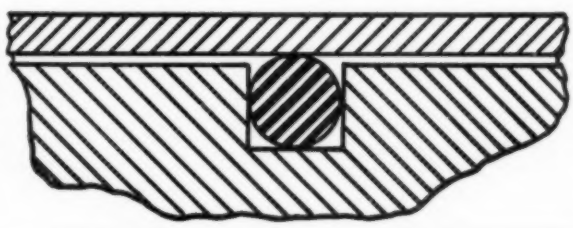


Fig. 2. A short groove design reduces or eliminates leakage. To take care of the swelling action of the fluid the area of the groove should be about 15 per cent greater than the "O" ring.

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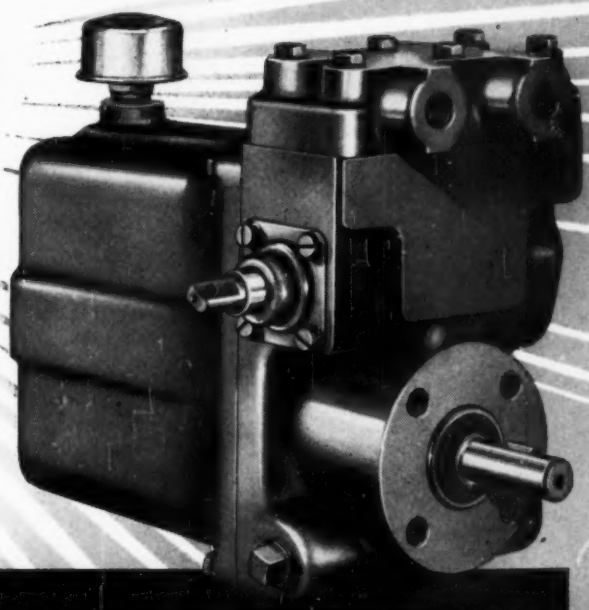

VICKERS POWER PACK

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AUTOMOTIVE

"Hydraul-Lift" Tail Gate of Cemco Industries, Inc., Galion, O.

CONSTRUCTION

"Profit Mover" of Construction Products Corp., Lynwood, Calif.

The Vickers Hydraulic Power Pack is a compact, self-contained hydraulic system which meets a wide variety of control needs in mobile equipment. It provides the machinery equipment manufacturer with a quick, easy, low cost installation which assures his customers of long trouble free service.

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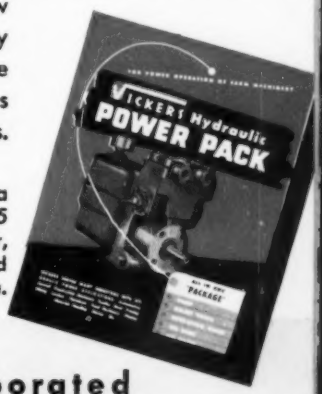

The Vickers Hydraulic Power Pack is a compact package weighing only 55 pounds. It incorporates an oil tank, filter, vane pump, overload relief valve and operating valve. Write for Bulletin 46-48a.

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SMOOTHING DOWN FINISHIN

Operated by hydraulic and air circuits, this surface finishing machine provides for both flat and adjustable contour movements. Now in use in the cutlery, hardware, hand tool and industrial fields, the basic simplicity, flexibility and production capacity of the machine has established a new low standard for finishing costs.

ONE OF THE OLDEST AMERICAN handicrafts industries is the making of fine cutlery. Like many industries based on skilled craftsmanship, the transitions to modern, high speed techniques were slow. This was particularly true of the polishing, buffing or surface finishing operations, which often remained hand operations after other operations were mechanized. It meant that in the manufacture of cutlery, the finishing departments grew to disproportionate size. While fine finishes were achieved by hand work, the operation was slow and therefore costly.

A hydraulic and air actuated surface finishing machine, built by Clair Manufacturing Company, Inc., of Olean, N. Y., permitted cutlery manufacturers to make the transition from hand finishing to automatic machine operation in one step. Originally a development for the production surface finishing of fine dinner knife blades, fully equipped models of the machine are now able to finish all types of cutlery, including knives, forks, spoons, machetes, straight razors and many others. Other industrial groups currently using these machines are: manufacturers of hand tools for adjustable and open end wrenches, pliers, chisels, axes, etc.; hardware manufacturers for such items as escutcheon plates, kick and strike plates, flatiron sole plates, etc., and; industrial jewelers for a wide variety of work, typical examples of which are mirror and brush backs, compact cases, trays and cigarette lighter cases.

The introduction of this type of machine and its development to wider applications in the cutlery industry has been a very interesting one. There was considerable reluctance in this field in yielding to mechanization. Modern competitive conditions and higher production requirements led cutlery manufacturers to gradually introduce modern techniques for most of their operations. Buffing or surface finishing was the last important operation to yield.

Although the first machines were introduced years ago, they were mechanically operated, which necessitated the incorporation of complicated and rapidly wearing parts such as cams, gears, worms and ratchets. In operation these machines were prone to develop excessive wear. This in turn introduced objectionable hesitation and inordinate maintenance.

Patented hydraulic circuits came to the rescue ten years ago when the first machine employing this type of actuation entered the field. These machines are functioning as smoothly and efficiently today as when first installed; maintenance has been negligible because closed hydraulic systems are not vulnerable to abrasives and cutting compounds as is the case with mechanical designs.

Hydraulic actuation proved a natural for the evident advantages it afforded to a type of machine that had to operate at high speed and continuous full load under conditions in which any down time was a serious problem. The hydraulic circuits permit flexible and simple adjustment of speeds and magnitude of stroke at any predetermined uniform velocity throughout the traverse, with absolute freedom from lost motion. Where emphasis upon coverage in critical or difficult areas, such as the heel of a spoon bowl, was impractical of attainment with mechanical actuation, a simple automatic throttling valve is easily set to provide a hydraulic dwell or slowdown over any predetermined area.

With the assistance and counsel of engineering talent in the field, the Clair company has perfected five models which are, in effect, custom built for intended applications. The original hydraulic features have served so well that they are incorporated, with additional hydraulic and air circuits, on all of the latest models.

To provide essential movements, a short, fast traverse travel and a longer, slower stroke for table travel at right angles to the first movement,

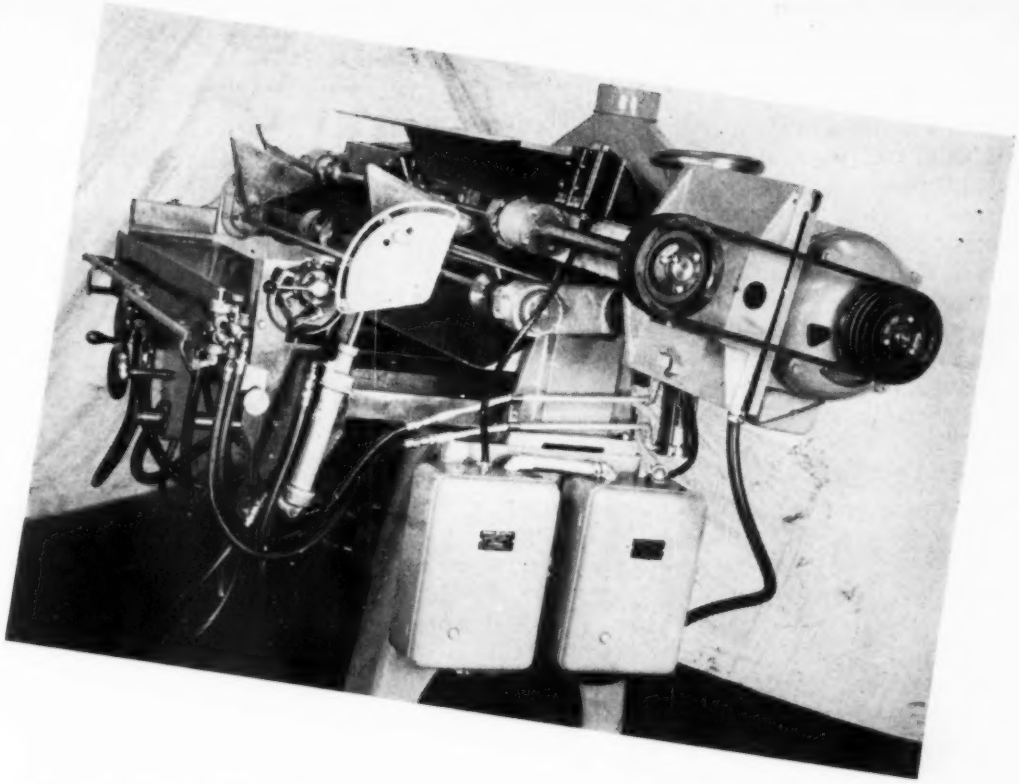

Fig. 1. A surface finishing machine ready for shipment. This unit is equipped with three hydraulic circuits: traverse, table travel and a quadrant for rocking or contour movements and an air circuit for opening and closing the buffs.

were necessary. Two low pressure hydraulic circuits provided the actuation. The traverse movement is actuated by a 2 in bore, 2 in stroke cylinder, controlled by a pilot operated 4-way valve. The forward and backward table travel is provided by a 4 in bore cylinder, the maximum stroke of which may be specified within the range of 14 in to 24 in. This cylinder is mounted beneath the bed of the machine and is controlled by a similar double acting valve, operated by adjustable limit dogs on the bed. Both circuits are supplied by a low pressure (100 psi) gear pump; fluid is directed into the circuits through a rotary valve, operated manually by a lever at the left front of the machine.

A third circuit, operated by air, serves to open and close the buffs to engage the work or to release it for loading and unloading. This circuit contains an accumulator, regulator valve, indicating pressure gage, filter and lubricator, by means of which any predetermined pressure is exerted against the work. Also, this permits the buff to float as they automatically open and close to allow for irregular contour or geometry without variation of pressure against the work. Both buffs may be single continuous rolls or they may be preformed as multiple individual rolls to conform to the contour of the work.

A hand screw adjustment may be set as a limit stop to hold the rolls apart in closed position as a means of permitting minimum buff wear due to contact and to compensate for normal wear down of rolls. The hand screw is not a pressure adjustment; roll pressure is an automatic function of the air system.

In response to an insistent demand for a device for holding non-magnetic materials such as brass, copper, aluminum and silver, a vacuum chuck was designed and incorporated into the basic machine. A perforated plate was mounted over a sealed air space, the space connected to a vacuum pump which is operated by a 4-way valve of single pedal, spring return design for foot operation. This vacuum chuck has proven convenient and successful to the point where applications have been expanded to magnetic materials and innumerable items.

About a year ago an inquiry came to the Clair company from a large industrial jewelry manufacturer. This company had the problem of high cost in finishing compacts, cigarette cases and cigarette lighters, representative of many items which required finishing. A production engineer was sent to the Clair plant where the details of operation were worked out on a pilot machine reserved for this purpose. A finishing machine was ordered and put into operation. This company's finishing problem was solved and at a cost far below their previous cost. This type of operation also utilizes the vacuum chuck for holding the parts.

Plants in the cutlery industry, using the surface finishing machine for knives and other

flat pieces, very naturally asked for modifications in design to permit the finishing of items with curved or contoured surfaces. The finishing of spoons, for example, presented a difficult problem since the bowls required a stroke or movement of the feeding fixture arm that would follow the interior contour of the bowls closely and accurately. The problem was complicated by the fact that spoons are made in practically an infinite variety of shapes and designs.

Some attempts were made to incorporate mechanical actuation, with indifferent success. With several cutlery concerns contributing toward the development, the problem was solved by a hydraulically actuated quadrant. The quadrant, mounted on the loading fixture arm, is controlled by a double acting hydraulic cylinder. Adjustments for spoon bowl depth and length were made by sliding the lock nut in a groove in the quadrant and by the shape of the loading fixture. Since the length of the traverse cylinder stroke is easily adjustable, any size or shape of spoon or of any other concave part can be surface finished as perfectly as a flat surface.

Modifications are made for individual users. For example, one manufacturer specified that the cycle be timed so that the machine always stops with the table at the out or forward position to assure ease and speed of loading and unloading of the work.

Although the hydraulic system operates at low pressure, high pressure valves are used throughout. This gives a much longer valve life and practically eliminates service maintenance.

In view of the numerous variables such as base metal, raw condition, roll make up and quality standards, time cycles may vary from 5 to 180 seconds. Cycles vary with the pressure used, the condition and shape of the buffs, the lubricant used and the character of the surface finish of the work as it comes from the hammers or presses.

PACKINGS AND SEALS

(Continued from page 10)

are entirely away from this theory. Square ends on both the bottom of the box and on the nose of the gland are now unqualifiedly advocated. A square end nose on the gland transmits the gland pressure centrally through the packing rings without causing excessive flow toward the moving part at the area adjacent to the gland.

(2) *Number of rings.* Experience has definitely shown that few rings of the proper design and construction are superior to a great number of rings, the construction of which are not best suited to the specific application. On reciprocating applications the use of too great a number of rings in the stuffing box shortens packing life; the lack of uniform compression permits the bottom ring to move away from the shoulder at the bottom of the box, permitting fluid under pressure to enter, compress the packing set and cause it to become loose and move back and forth with the stroke of the rod.

(3) *Spring loading.* Attempts by designers to solve packing problems by imposing a spring or a series of springs behind a packing set to compensate for wear and to keep the compression at the desired load have been made. Experience teaches that this is undesirable and impractical. Such a design frequently permits the packing set to ride with the rod, causing premature wear and unsatisfactory sealing.

(4) *Individual ring compression.* The life and service obtainable from packing depends primarily on application and secondarily on gland compression, particularly during the initial periods of operation. The practice of attempting to compress the whole set of packings by means of the gland itself, has proven unsatisfactory, since it often results in over compression of the rings adjacent to the gland nose and in loose rings in the bottom of the box. It is very desirable to compress each ring individually as it is installed. This can be done by means of wooden collars, which are in turn compressed by the gland. During initial operation any compression packing set should be permitted to leak for a short time to permit the packing to find its own balanced position in the stuffing box. When gland adjustment is made to reduce leakage, intervals of ten to fifteen minutes should be allowed between adjustments. Always permit sufficient leakage to assure proper lubrication at the line of shaft or rod contact.

(5) *Shaft metallurgy.* Shaft metallurgy and hardness factors are important in determining the type and style of packing that should be used for any given application. Finish of the shaft or rod is also important; superfinish is desirable and recommended wherever practical.

(6) *Bleed-off line.* On high pressure applications it is usually desirable to provide a bleed-off line in or near the bottom of the stuffing box to reduce the pressure load on the packing to the lowest pressure in the hydraulic system adjacent to the pump.

(7) *Need for standardization.* It is the concensus of opinion in the packing industry that much could be accomplished by a committee on standards, whose function would be to set up universal specifications for gland construction and proportions. This would result in considerable overall economy and in increasing satisfactory performance, especially on such items as valves, centrifugal, rotary and reciprocating pumps and a host of mechanical appliances which use various types of packings.

From a paper presented at the 1948 National Conference on Industrial Hydraulics, October 1948. Papers are available in bound form by addressing Mr. S. F. Musselman, National Conference on Industrial Hydraulics, Technology Center, Chicago 16, Ill.

Part 2 of Mr. Schmitz' paper in which he treats mechanical seals will appear in an early issue—The Editors.

LETTERS to the Editor

The writer is interested in procuring a rotating or swivel effect union in the smaller (⅛, ¼ or ⅜ in) pipe sizes. The speeds of rotation will be in the order of 100 to 200 rpm and the pressure, which we want to put into the end of the rotating shaft, will probably not exceed 75 psi. One-half of the union will be fixed. We should like to have something like a ball joint or a low friction unit.

G.F.B.

The names and addresses of two companies that can supply such a swivel union have been sent you.

Will you please send us available information on hydraulic or air operated turn tables 18 to 30 in diameters, or any size over 18 in and under 30 in, such tables to have at least 12 stages or any number in multiples of four.

J.T.S.

We assume you are interested in standard index tables of the sizes specified. The office of the National Machine Tool Builders Association suggests that several milling machine manufacturers be contacted. There are a number of companies that make hydraulic and air cylinders and related equipment suitable for operating such tables. Several suggested sources have been forwarded.

We have several air cylinder jobs in our shop and the only difficulty we have with them is in controlling their speed. We have tried several remedies but they do not give uniform results.

J.L.N.

An article on "Predetermined Speed Control of Air Cylinders", by Paul H. Winter in the August 1948 issue of "The Tool Engineer" gives some excellent data in tabular form on a simplified speed control for air cylinders based on drilled holes that may be useful to you. Also consult the engineering department of your source of supply.

On page 18 of the December issue of APPLIED HYDRAULICS a box at the end of the story on the New Hydraulic Standards for Industrial Equipment, states that we should ask our supplier for copies. Would you advise us the names of those firms that can furnish copies of the Standards.

C.E.R.

We have received a number of such requests. For the present, the distribution of JIC Hydraulic Standards for Industrial Equipment is being handled by General Motors Corporation. Copies may be secured by addressing Mr. J. C. Rauss, Production Engineering Section, General Motors Corporation, 15-228 General Motors Bldg., Detroit 2, Mich.

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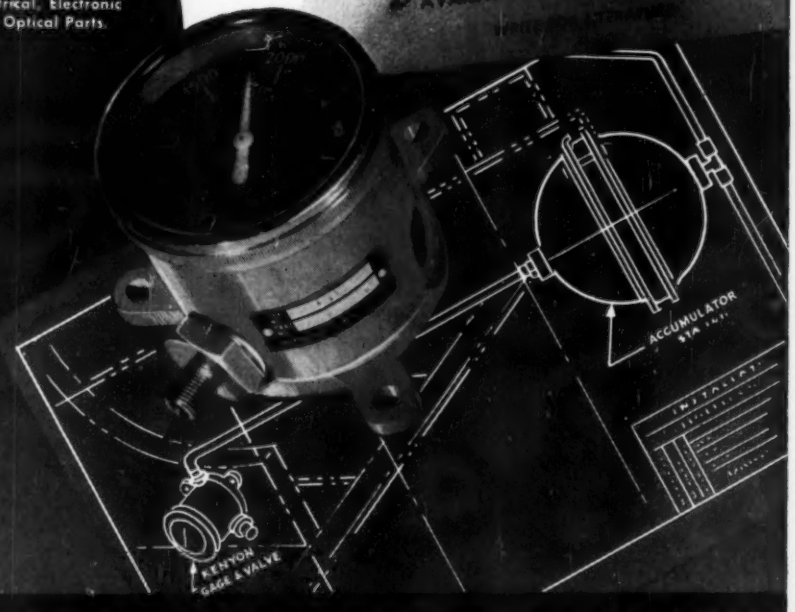

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"O" RING LEAKAGE

(Continued from page 14)

Each time the seal rolls it tends to leave a very small amount of fluid on the low pressure side of the surface against which it is sealing. The action can be compared to printing or the rolling of ink on paper. The seal can also roll air or a similar gas into the fluid. While this may be very small amount, it can be enough to cause trouble on some critical installations.

Leakage can be greatly reduced or eliminated by reducing the length of the groove (see Figure 2). This prevents much of the rolling action and usually makes assembly of the unit easier. However, it tends to increase breakout friction and reduce seal life. When reducing the reciprocating seal groove length, the designer should take into consideration the swelling action of the fluid on the rubber "O" ring. It can be generally stated that the area of the groove should be about 15 percent greater than the "O" ring. This is adequate expansion space for most installations where the aniline points of the hydraulic fluids do not vary over too wide a range.

A very smooth metal surface finish, 15 microinches or less as measured by a profilometer, is recommended for surfaces over which an "O" ring must reciprocate. Contrary to many recommendations and specifications, the groove surface should be between 60 and 100 microinches, approximately a good mill finish. The rougher groove not only tends to reduce or eliminate leakage but helps prevent excessive rolling and twisting of reciprocating gland seals.

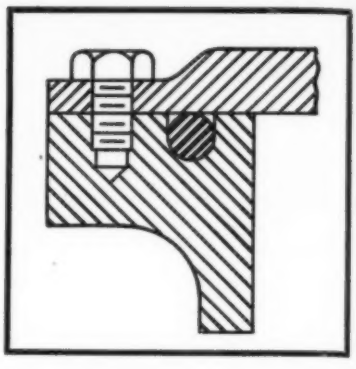

Fig. 3. A round bottom groove design for positive static sealing or vacuum installations. The "O" ring should protrude above the top of the groove from $\frac{1}{32}$ to $\frac{1}{64}$ in.

Oversized and undersized glands, with respect to the seal, tend to accentuate the leakage problem. If the "O" ring is stretched too much in the gland, it may take a higher permanent set than usual, due to its tendency to return to its original shape. As a result it may pull itself completely away from the sealing surface, even though a positive squeeze was originally applied. If the gland diameters are less than that of the "O" ring, the problem is not as serious. However, buckling of the "O" ring may occur and can conceivably cause trouble. An increase of squeeze is usually desirable if odd sized glands have to be used.

In the last paragraph of Mr. McCuistion's article "The Correct Use of "O" Rings on Valve Seats" the word "rotary" was used in reference to a type of groove. Mr. McCuistion wishes to clarify this type of groove as a dove-tail or undercut retaining groove.—The Editors.

Static seal leakage is rather uncommon but occasionally it does occur. Basically, it is caused by much the same action as described above. Rougher surfaces (60 to 100 microinches) on rectangular static seal grooves tend to hold the seal and prevent the rolling and sliding or pumping action. The so-called pumping action is due to the distortion of the seal by varying pressures.

Harder "O" ring compounds (80 to 90 durometer) can not be distorted so readily and are often used to eliminate leakage troubles instead of making a design change. However, harder compounds sometimes cause assembly difficulties. This is particularly true of large piston type units installed into cylinders which have a relatively rough surface.

Round bottom grooves and rectangular grooves with the length about the same as the "O" ring cross section are desirable where positive static seals are required. Figure 3 illustrates a round bottom groove design. It should be noted that the radius at the bottom of the groove is the same as the "O" ring cross section radius. The "O" ring should protrude above the top of the groove from 1/64 to 1/32 in.

When the maximum seal life is required and no leakage can be tolerated, two "O" rings can be used in adjacent long grooves. As shown in Figure 4, it is necessary, on double acting piston type glands to bleed the space between the two seals to a return line or to the atmosphere. This prevents a so-called "pressure-lock." A pressure-lock is the building up of pressure between the two seals, which results in rapid seal wear. Wear is apparently accelerated due to the friction and the pressure acting in the same

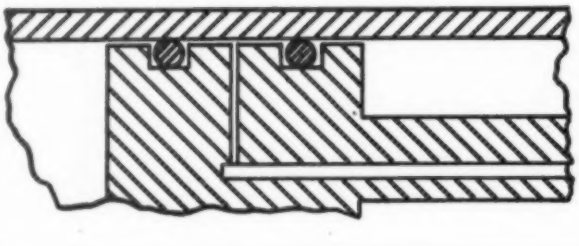

Fig. 4. A reciprocating gland with bleed between the two seals eliminates leakage and gives maximum seal life. Bleed is to the atmosphere or a return line.

direction on the return stroke. This causes the "O" ring to have more of a tendency to extrude. Sometimes two seals can be used to advantage, without bleeding, on gland assemblies where sealing is necessary in one direction only. For example, a rod seal which is exposed to the atmosphere on one side and the oil pressure on the other. The groove next to the pressure is usually rather short and the other a standard design. In such cases the pressures are usually under 1000 psi.

It is possible to reduce "O" ring leakage on reciprocating mechanisms so that it is not a problem. However, it must be realized that each design has its limits and its idiosyncrasies. By understanding the basic causes for "O" ring leakage, the designer can, as the need arises, work out the best possible compromise with a minimum of effort.

HEAVY DUTY MOWER

THE ASHPLUNDH TREE EXPERT Co., Erie, Pa., is a specialist in clearing landing field strips, fence, wire and pipe line routes. As the major job most frequently encountered is the clearance of second growth shrubs and small trees with boles up to one inch diameter, the problem of the most efficient equipment was critical. The ordinary tractor-mounted mower, excellent for heavy grasses and small shrubs, was stalled by the heavier growth. Heavier equipment with blades would run the cost well beyond the average customarily allowed for such clearance. The problem was solved by the use of a hydraulically powered heavy duty mower attachment.

According to Ed Weimer, Manager Tractor Division of the Ashplundh Company, the hydraulic mower has a more consistent power than any belt driven machine that they have used. With the speed regulated to about 760 strokes per minute, the smooth, quiet flow of power cuts two inches of green wood brush.

The hydraulically actuated mower actually is a high speed shearing machine, although the standard horizontal type of blade cutter is employed. The power unit is an assembly of four compact cylinders, one and one-eighth inches in diameter, mounted in a compact housing. The two pumping cylinders have a stroke of 3 in and develop a maximum cutting pressure of 650 psi. Two reciprocating cylinders, operated by an oscillating plate, control the blade action.

Two by-pass valves act as safety releases. A safety break back for raising the cutter bar above or away from heavy obstructions eliminates backing up, speeding linear clearance.

The knives in this unit are 5 to 6 times as long as the commonly used blade knives. The cutting action is a shearing one with the smoothness characteristic of hydraulic power.

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Useful Literature

The publications listed are available without charge. Mark the initial key number on the card bound in this issue and mail.

25. Packings . . . Navalon Packings, a new development, are described in a bulletin just released by Johns-Manville. These packings are strong, abrasive-free and are recommended for pumps, elevators, accumulators, presses and reciprocating rods and plungers. Performance is best in cold oils and many other liquids. Three styles are offered in sizes ranging from ¼ to 2½ in, in ⅛ in increments. Other packings made by this company are also listed in this bulletin.

26. Hose Assemblies and Couplings . . . Anchor Coupling Co. Inc., offers a 25 page loose leaf catalog, No. 49, illustrating and describing their line of hydraulic hose, couplings and assemblies. In addition to detail drawings and dimension charts, engineering information and application photographs are included. Low, medium and high pressure coupling units are offered for pressures ranging to 6000 psi. Wire and rayon braid hose, for the same pressure range, are offered in additional insulated and suction types. Also shown are pipe fittings and spring guards.

27. Water Hydraulic Controls . . . Hydropress, Inc. has available Folder AJ L-43 dealing with hydraulic control, prefill, stop, check, by-pass and shut-off valves for water hydraulic service. Valve combinations for sequence operation are also included. Detail drawings and photographs are shown for each type of valve and complete application data on these custom built units is included.

28. Flow Charts . . . Now available from Miller Motor Company are new air and hydraulic pressure and flow charts containing valuable and useful data that usually requires extensive calculations to derive. The charts and tables are easy-to-read and cover push and pull stroke pressures of cylinders, piston rod diameters, pipe sizes for well designed hydraulic circuits and pipe fittings and valve friction pressure losses. Also shown are the types of cylinders produced by this company. Two chart sizes are offered for wall or notebook use.

29. Limit Switches . . . Bulletin EM-47 describes the standard limit switches produced by The National Acme Company. Regular style, push lever style, explosion and water resisting and neutral position units are included. Each type is illustrated by design detail drawings and a photograph. One page contains an exploded view of the basic switch and identifies each component part. These switches are designed for heavy duty.

30. Pressure Plugs . . . Unbrako pressure plugs, manufactured by Standard Pressed Steel Company, are reviewed in bulletin 700. These entirely new precision-made plugs are designed for oil, water, steam and air pressure applications. They are offered in standard pipe sizes ranging from 1/16 to 1¼ in. Line drawings included in this bulletin show the advantages of the uniform taper, fully-formed thread and perfect roundness of these plugs over ordinary pressure plugs. Dimensions and prices are shown.

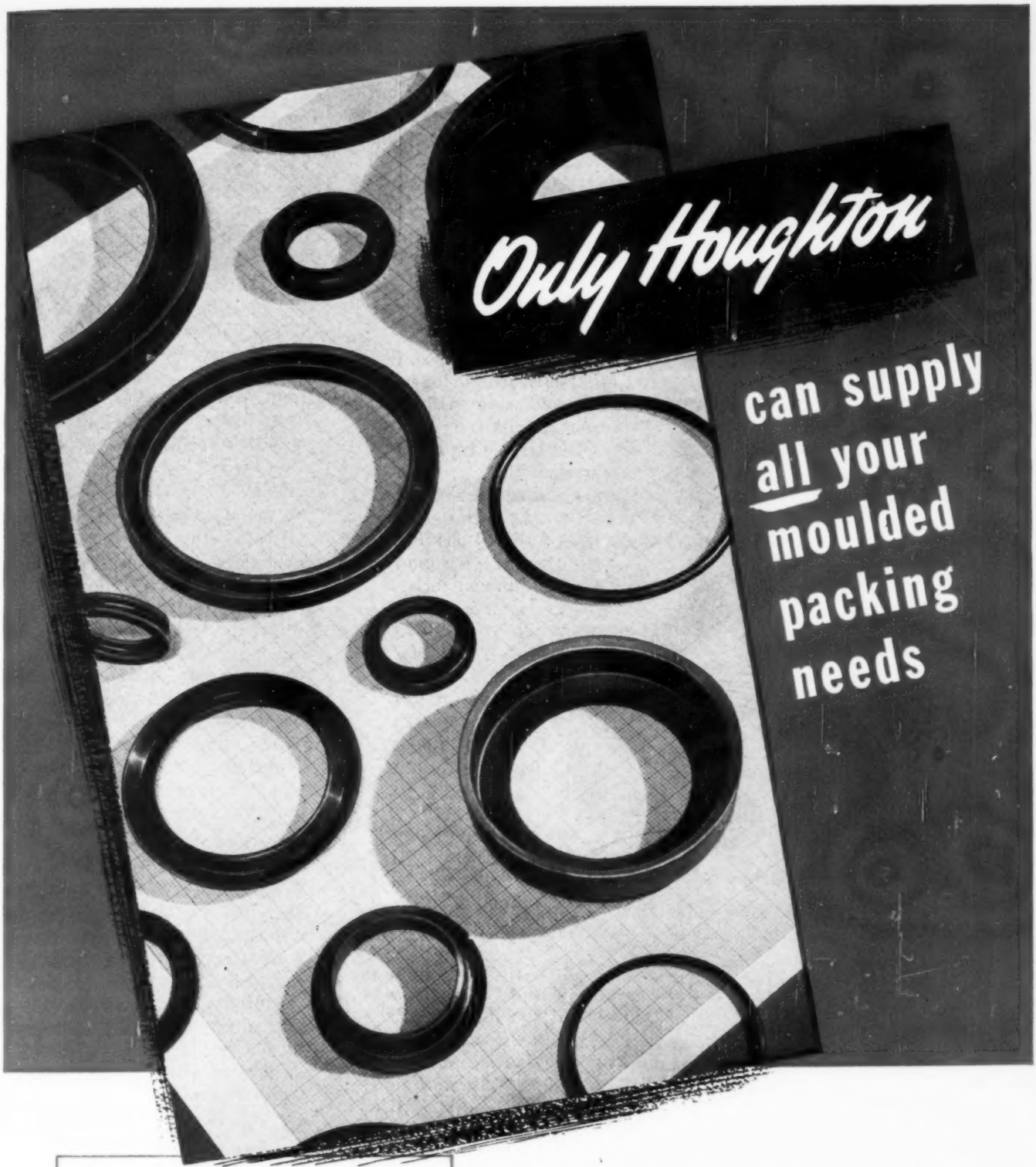
31. Air Cylinders . . . Bulletin AH-103 reviews the air hoists and cylinders produced by Northern Engineering Works. Both the cylinders and hoists are completely described with detail drawings and dimension charts—several application photos are also included. The cylinders and hoists are furnished in sizes from 3 to 10 in for pressures from 60 to 100 psi. The cylinders are furnished with improved type non-packed disc valves of 2-,3-, or 4-way construction. Seven mounting types are offered.

32. Swivel Joint . . . Bulletin No. 4800 describes, with drawing and dimension chart, the all-metal Swivlex Joint manufactured by Seamlex Company, Inc. Recommended for steam, water, oil and air, this swivel joint incorporates stainless steel bellows and permanently sealed metal-to-metal seat. They are offered in five pipe sizes from ¼ to 1 in for working pressures to 400 psi.

33. Hydraulic Regulators . . . Bulletin No. 600, Shallcross Controls, Inc., is devoted to the automatic hydraulic regulators produced by this company. They are designed for control of pressure, volume, flow, ratio and mixture and consist of a sealed-in oil sump, direct-driven oil pump, pressure differential sensing mechanism and a frictionless control valve. Also available are hydraulic power cylinders controlled by this regulator. Both units are described in this bulletin.

34 Air Compressor Lubrication . . . The major part of this 52-page booklet is given over to a systematic survey of the types of compressors in use by industry. Single, two, three and four stage compressors, grid, plate, corliss and poppet valves are shown in detail, in many cases by multi-colored nomenclature-and-function drawings. The lubrication of cylinders, valves and bearings is treated in separate sections. Recommendations for the correct oils for reciprocating air compressors, operating notes and rules for air compressor operation are given. The lubrication of rotary displacement compressors and of turbo compressors is included. This booklet is made available by Socony-Vacuum Oil Company, Inc.

(Continued on page 24)



VIM LEATHER
and
VIX-SYN RUBBER
Engineered
PACKINGS

No one type of packing will fill all needs. That's why we supply all kinds: VIM Leathers of many shapes and consistencies, Vix-Syn fabricated and homogeneous synthetic rubber, and "O" rings. This complete line enables Houghton to make unbiased recommendations based on service conditions. We invite inquiries for both packings and engineering advice. Write—

E. F. HOUGHTON & CO.
303 W. Lehigh Ave., Phila. 33, Pa.

(Continued from page 22)

35. Asbestos and Rubber Packings . . . The asbestos and rubber packings produced by The Darcoid Company, Inc., are reviewed in Catalog No. 10. Square or round packings are available in asbestos, rubber, flax, copper, lead and semi-metallic for all types of work at any temperature. Sizes range from ¼ in. The last few pages of this catalog are devoted to engineering data.

36. Rod Packings . . . Quaker Rubber Corporation offers literature, in a series of 4-page leaflets, describing piston rod packings for water, air and high pressure hydraulic work. Construction drawings and available sizes are listed in addition to prices now in effect.

37. Vibration Absorbers . . . Packless Metal Products Corporation produces a line of absorbers for use wherever vibration and noise are developed from pulsating pressure on gases or liquids. These units are described in Bulletin VA-2.

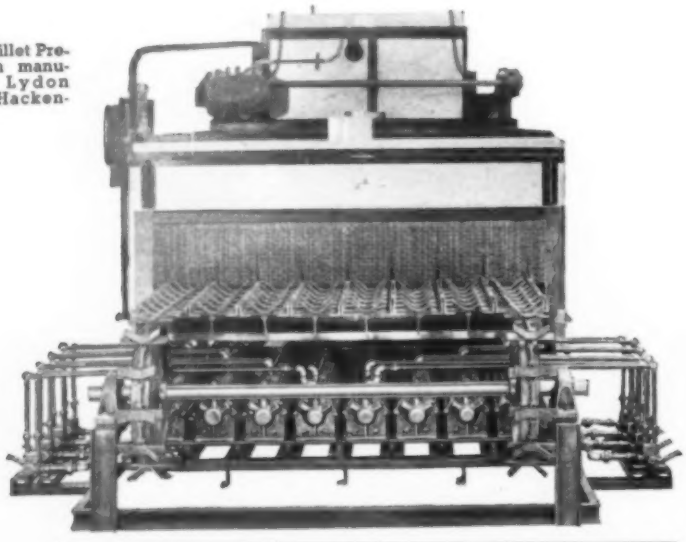
38. Hydraulic Valves . . . Single- and two-pressure hydraulic valves, for pressures to 5000 psi, are described and illustrated in detail in Bulletin H-210 offered by Yarnall-Waring Company. Two-, three- and four-way types are offered in five sizes from ½ to 1½ in. These valves are recommended for use on hydraulic presses producing rubber, plastic and fibre board items and incorporating single and two-pressure set ups. Design detail drawings and dimension charts are included in this bulletin.

39. Air Compressors . . . Bulletin No. 60, available from Schramm Inc., describes portable and stationary mounted air compressors produced by this company. The stationary units are mounted on a box base and the portable units are skid, trailer and crawler mounted. Numerous application illustrations showing these 60 cfm units in operation and dimensional charts giving sizes and capacities are included.

40. Magnetic Valves . . . The catalog of Magnatrol Valve Corp. illustrates and describes the line of magnetic valves designed for use with automatic control apparatus for hydraulic, air and other types of power. Normally open, normally closed, full port normally open and closed valves are included in ranges of sizes to take care of most control circuits.

41. Agricultural Hydraulic Pump . . . The Hi-Lo-Pac, a unit incorporating a 3 gear double pump, combination two and four way valves, all self-contained, filter, safety valve and reservoir in a single housing, is offered by the Char-Lynn Company. The unit is provided with a rigid 4-point mounting and flexible coupling connection to power take-off for operating range of 250 to 750 rpm. Designed for maximum operating pressures of 1000 psi, the unit is available in six models.

End view of Billet Pre-Heating Oven manufactured by Lydon Bros., Inc., Hackensack, N.J.

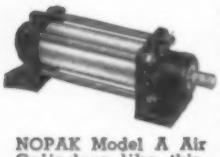


8 Model R Foot Valves, with spring return, permit moving conveyor chains any distance up to 30".

Conveyor Chains on Pre-Heating Ovens are Powered by NOPAK...

Lydon Bros., Inc., Hackensack, N. J. . . . designers and manufacturers of industrial ovens and dryers . . . employ 8 NOPAK Model A Air Cylinders controlled by 8 NOPAK Model R Foot Valves in this Billet Pre-heating Oven, to actuate the conveyor chains which feed billets into the oven.

Each of the 6" cylinders has a 30" stroke, and is ratchet coupled to one of the conveyor chains. Thus each chain is operated independently, and may be advanced any distance up to 30" with each depression of foot valve pedal. This makes the conveyor system both flexible and selective, an important advantage in this particular case . . . Possibly a similar application of NOPAK Valves and Cylinders can help pull one of your design or production "chestnuts" out of the fire.



NOPAK Model A Air Cylinders like this, with 30" strokes, are used on the Lydon Bros. Oven.

GALLAND-HENNING MFG. CO.
2743 SOUTH 31st STREET
MILWAUKEE 7, WISCONSIN

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

Representatives in Principal Cities

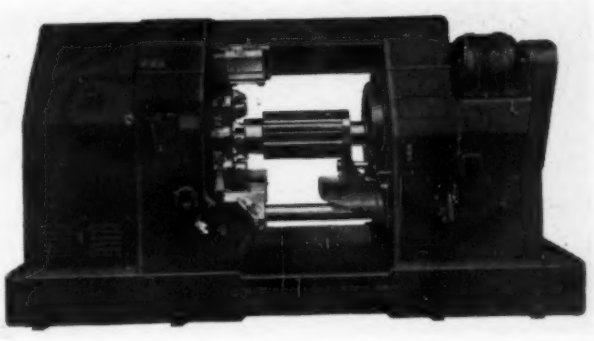
J. H. DRISCOLL, Park Sq. Bldg., Boston 16, Mass.
PAUL B. HUYETTE CO., INC., New York 17, N. Y.
W. E. CRANER, Houston 6, Texas
ROSS ENGINEERS, Rochester 4, N. Y.
SUPPLIES, INC., Pittsburgh 12, Pa.
BRENNER INDUSTRIAL SALES, Youngstown 5, Ohio
L. H. MONSEES, Independence, Mo.
GARRETT BURGESS, INC., Detroit 4, Mich.
HACKETT BROS., INC., North Manchester, Ind.
F. W. SORGENFREI, Chicago 4, Ill.
JOHN HENRY FOSTER CO., St. Louis 18, Mo. Minneapolis 4, Minn.
E. C. GRIFFIN CO., Seattle 4, Wash.

THE NATIONAL ACME COMPANY

CHUCKING AUTOMATICS

The National Acme Company, leading builder of automatics, vertical threading and boring, thread and form rolling machines, as well as machine tool control elements, utilizes a hydraulic pressure system for operating the spindle clutch and brake (automatic) and for chucking the work (semi-automatic) in all sizes of the model RPA chucking machines they manufacture.

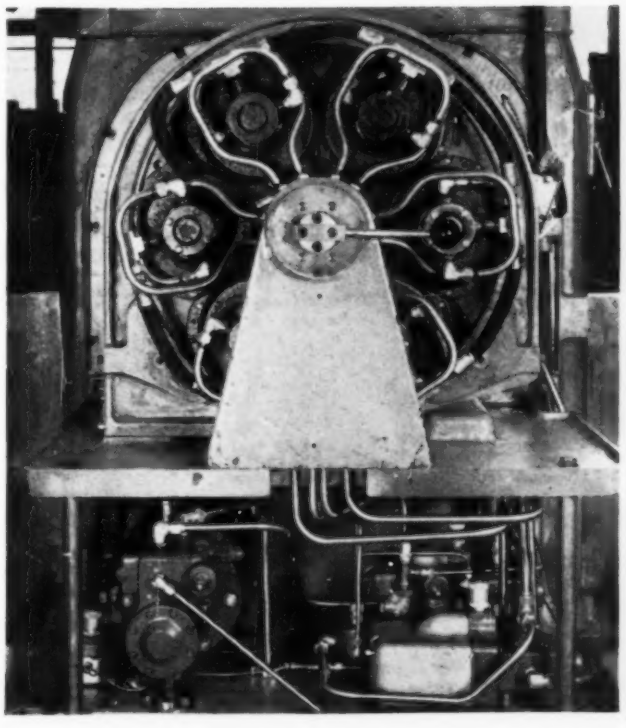
Model RPA Chucking Automatics



General: The design and application of the hydraulic system is the same for all sizes of standard 4, 6 and 8 spindle machines. The 8 spindle machine may be arranged for double indexing.

Specifications: Bulletin No. CM-43B.

Hydraulic Circuits: The circuit contains a standard two-pressure Vickers pump, motor and two sets of 4-way solenoid operated valves actuated by Namco heavy duty Snap-Lock limit switches. One set of solenoid valves operates the spindle stopping mechanism, the other the chuck operating mechanism.



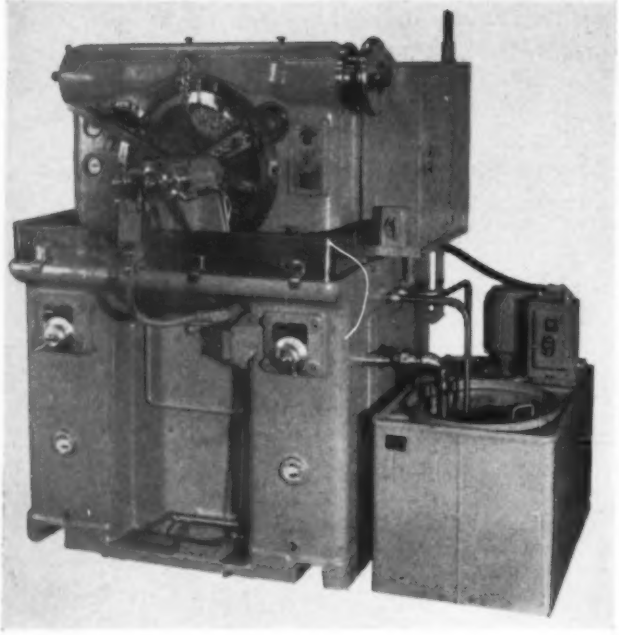
Application Job Set-Ups: Bulletin CM-44.

Proper Care and Operation: Handbook for Operators—Bulletin CMH-1.

Oil Recommendations: Bulletin CMH-1.

THE NATIONAL ACME COMPANY

THREAD AND FORM ROLLING MACHINES



Roll-Matic TR-1 Machine

General: This production machine is designed primarily for threading standard solid or hollow parts ranging from the smallest to 1½ in diameter. It meets high precision requirements for first and second operation work such as burnishing, knurling, serrating and continuous feed-through work bars. Three 3-roll heads (work ⅜ to 1½ in) and a 2-roll head (work up to 9/16 in) are interchangeable.

Specifications: Bulletin No. TR-47.

Hydraulic Circuits: Two pumps, driven in tandem by a single 10 hp motor, rotate the work spindles (18 gpm) and operate the piston controlled rack which oscillates the cam ring and times the cycle (8 gpm).

Attachments Available: Hand loaders, automatic magazine loaders—Bulletin No. TR-47.

Operation, Service and Parts Manual: Handbook and Parts List—TR-1.

Proper Care and Operation: Handbook and Parts List—TR-1.

General Bulletins are available on request from The National Acme Company, Cleveland 8, Ohio. While the supply is limited, handbooks will be furnished to operators or prospective users of machines. When making a request please give serial number or type of machine of specific interest.

All National Acme machines and attachments are protected by issued and pending United States and foreign patents.

New PRODUCTS

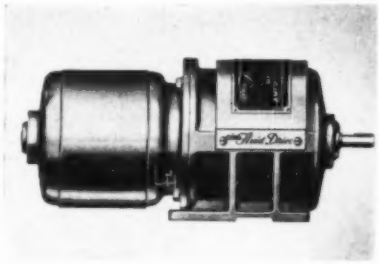
For additional information on any of these products, mark the end key numbers on the card bound in this issue and mail the card.

Three Way Air Valves

A new, larger finger-tip valve, FT-101, is announced by Mead Specialties Company. Expressly designed for quicker action with larger cylinders, the three-way valve has 5/16 in openings throughout, is easy to mount with either vertical or horizontal mounting holes and can be hooked up with parallel hose nipples from back of valve. Use Business Reply Card, mark NP-1.

Fluid Drive Units

A new line of hydraulic electric power units with built-in Gyrol Fluid Drive is announced



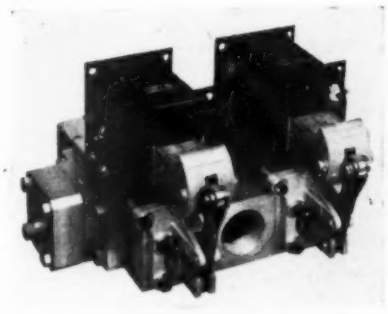
by American Blower Corporation. The first units available are powered with 5 and 7½ hp motors; sizes in the complete line will run from 1 to 20 hp. The units will have NEMA mounting bolt hole dimensions and will be complete with electric motor and make the advantages of Gyrol Fluid Drive available to all industrial power users. Current saving, positive overload protection, protection from shock and simplified application are among the advantages. Use Business Reply Card, mark NP-2.

Precision Feed Controller

A new Power-Check precision feed controller, a self-contained hydraulic cylinder and operating rod for nose mounting through a bracket to the moving element of any feeding mechanism, is announced by National Pneumatic Company. Applied to either pneumatic or manual drill feed press, the controller can be adjusted to retard the drill through the entire cycle or to ease the drill through the breakthrough point. For milling and grinding operations the controller can be utilized to give precision-controlled speed to eliminate chatter and backlash. Standard units are available with 2, 3, 4 or 6 in stroke. Use Business Reply Card, mark NP-3.

Dual Pressure Selector Valve

A new electrically operated dual pressure selector valve designed for conversion of semi-automatic and manually operated hydraulic equipment actuated by low and high pressure accumulator systems, has just been announced by Saval, Inc. Designed specifically for water pressures up to 7000 psi, the "Shear-Seal" principle permits direct solenoid actuation of the valve; the direct action

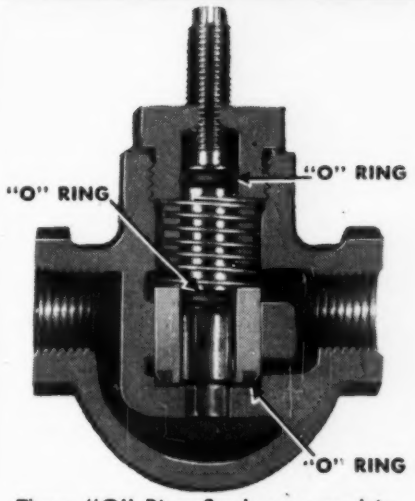


assuring fast, positive action. Pilot lines are eliminated, saving space and cost. The new valve will accommodate screwed, welded or flanged connections up to 2 in on pressure ports and 2½ in on the return port. The valve may be used on oil or air applications. Use Business Reply Card, mark NP-4.

USE "O" RING SEALS

(The modern packing method)

FOR SIMPLICITY • RELIABILITY
LOW COSTS • SPACE SAVINGS



Three "O" Ring Seals are used in this Automatic Cylinder Speed Control Valve made by AIRMATIC VALVE, INC. of Cleveland, Ohio. This valve, placed in a fluid line between the operating valve and the cylinder, automatically controls the piston stroke at any selected speed.

The lower two "O" Rings in the poppet assembly are rolled into special grooves. The adjustment stem "O" Ring is installed in a standard groove. All are leakproof on air, oil or water to pressures over 1000 P.S.I.

This valve is one of many examples that prove how "O" Ring Seals solve tough problems.

• Investigate "O" Ring Seals. Consult the "O" Ring specialists. Send for our "O" Ring Handbook. It's free.

PLASTIC and RUBBER Products, Inc.

Dept. 1, Oakridge Dr., Dayton 1, Ohio

High Pressure Solenoid Valves

A complete new line of solenoid valves for hydraulic systems with operating pressures to 3000 psi, is announced by Waterman Engineering Company. Available in two-, three- and four-way, normally open or closed types, they are compact; poppet type construction locks fluid in one direction while permitting free flow in the opposite direction. Available for any voltage from 6 to 36 v, dc, the valves are furnished with any combination of open or closed ports. Use Business Reply Card, mark NP-5.

Corrosion Inhibiting Plugs

Corrosion inhibitor zinc rods or plugs, fitted with standard pipe-plug ends, are offered by Rotometals, Inc. The "Cor-In" rods, having higher electrochemical potential than the metals to be protected from corrosion, are consumed by oxygen and other corrosive agents. Designed to protect heat exchangers, piping and other hydraulic equipment, the rods are available in ⅜, ½, ⅝, ¾ and 1 in diameters, with lengths up to 12 inches. Use Business Reply Card, mark NP-6.

Synthetic Sealing Washers

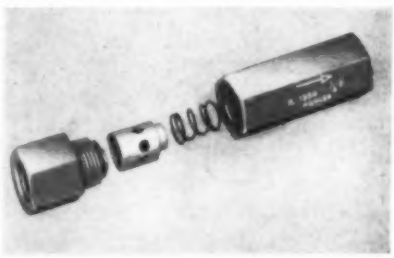
An "O" ring type of sealing washer with metal retainer has been put on the market by the Franklin C. Wolfe Co. With a locking as well as sealing action, the Lock-O-Seal washers provide the same full metal-to-metal bearing surface as standard washers, are easy to install, require no special tools and are inexpensive. The manufacturer recommends them for use in hydraulic systems, compressors and in a wide range of applications under bolt and screw heads. Use Business Reply Card, mark NP-7.

Rotary Solenoids

Two new rotary solenoids have been developed by G. H. Leland, Inc. One will produce 25 lb-in. starting torque with a 45 degree rotary stroke and the other will produce 50 lb-in. starting torque with the same degree of stroke. Dustproof cover and return spring are optional. A variety of wire sizes permits operational choice from 6 to 550 volts dc. Use Business Reply Card, mark NP-8.

All-Purpose Check Valve

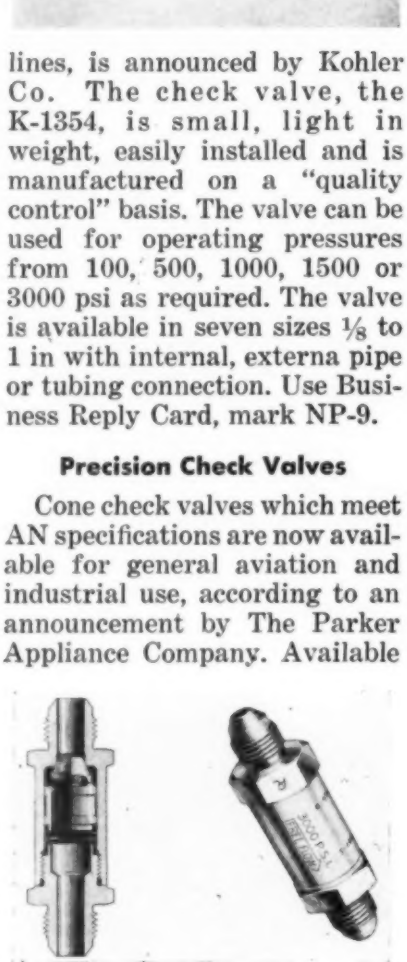
A "leakproof" valve, for low as well as high pressures, which can be used on air, oil, gas, water and other fluid power



lines, is announced by Kohler Co. The check valve, the K-1354, is small, light in weight, easily installed and is manufactured on a "quality control" basis. The valve can be used for operating pressures from 100, 500, 1000, 1500 or 3000 psi as required. The valve is available in seven sizes ⅛ to 1 in with internal, externa pipe or tubing connection. Use Business Reply Card, mark NP-9.

Precision Check Valves

Cone check valves which meet AN specifications are now available for general aviation and industrial use, according to an announcement by The Parker Appliance Company. Available



with anodized aluminum bodies and stainless steel poppets for pressures up to 1500 psi and with cadmium-plated steel bodies and heat-treated steel poppets for service to 3000 psi, ports are male or female threaded in ⅛ in to ¾ in pipe size for tube sizes ¼ in to 1 in OD. Connection ends are flared in conformance with tube fitting specifications of the JIC. Use Business Reply Card, mark NP-10.

Quick Exhaust Valve

A newly designed quick exhaust valve, introduced to industry for further automatic control of machines, is announced by Airmatic Valve, Inc. The model QE-500 series is unique in that fluid pressure opens the exhaust port to atmosphere when the main control valve is returned to normal position in a line close to the cylinder. The valving action is operated by fluid through two poppet elements, reducing fluid friction and increasing speed as much as 50 to 100 percent. The valves can be used for air, oil or water at pressures to 200 psi. Use Business Reply Card, mark NP-11.

Axial Flow Compressor

Fredric Flader, Inc. introduces a new line of axial flow air compressors that utilize an entirely new principle of industrial compressor design. This principle embodies the results of modern aerodynamic research; the rotor blades are designed as individual airfoils and the rotors and stators both produce compression. These units are highly efficient, compact and can utilize any type of drive. Pressures to 100 psi can be obtained with capacities ranging to 300,000 cfm. Use Business Reply Card, mark NP-12.

Hydraulic Pressure Regulator

O. C. Keckley Company announces an improved hydraulic pressure regulator for pressures up to 5000 psi for oil or water service. Primarily designed for the reduction of high initial pressures to secondary operating pressures the new type H pressure regulator has a wide range of adjustment. It is particularly adapted for restricted flow of accumulator service. The regulator is single seated, normally open and throttles to closed position. Various springs are available for either wide or limited pressure ranges. Use Business Reply Card, mark NP-13.

Applied HYDRAULICS DIGEST

Abstracts, summaries and listing of articles on hydraulic and associated applications in industry; reports on prepared papers, talks and discussions of special interest to the hydraulics field.

Air and Hydraulic Clamping for Jigs and Fixtures

Harry L. Stewart, *Tool Engineer,* v 21, December 1948, pp 25-28.

When air is available, air equipment for clamping is lower in original cost than hydraulic equipment; however, the popularity of the "package" hydraulic power unit is steadily gaining because of its flexibility and compactness. A general rule is suggested: for a large amount of power, minimum space, average cycling and normal heat—use hydraulics; for medium pressure, plenty of space, high cycling and high temperature—use air. Advantages of the use of air or hydraulics over mechanical means for clamping jigs and fixtures are: (1) increased production; (2) decrease in rejections and scrap; (3) elimination of costly mechanisms; (4) reduced maintenance; and (5) reduced operator fatigue. Schematic diagrams and photographs of representative installations are given.

Fundamentals of Forging Practice

Waldemar Naujoks, *Steel,* v 123, December 6, 1948, pp 121, 122, 124, 127, 158, 160, 162.

This final article (part 14) of a forging series is a nomenclature list of words and phrases used in the commercial forging industry. Tables of tapers for draft angles, maximum forging temperatures and weights of forging metals for the entire series are included.

Hydraulic Systems in Stretch Forming Machine

J. A. Helget, *Electrical Manufacturing,* v 42, December 1948, pp 86-89, 188.

A 50-ton stretch forming machine recently built by Hufford Machine Works, Inc., Redondo Beach, Cal., employs three independent hydraulic systems. One system, operating at 2000 psi,

Let it vibrate... Let it flex...

The B. M. Root Company of York, Pa., makers of this Multiple Spindle Hydraulic Feed Wood Boring Machine, depend on Resistoflex hose for enduring performance of hydraulically operated clamps.

You needn't ever worry about feed-line fatigue as long as RESISTOFLEX hose is transmitting your hydraulic power. For RESISTOFLEX has *flexibility* and *fatigue resistance* to absorb continuous vibration—plus uniform, reinforced construction to withstand shock loads. On the above machine, for example, RESISTOFLEX hose assemblies sustain up to *60 load applications per minute!*

RESISTOFLEX hose is impervious to oils and hydraulic fluids because *compar,* of which its tube is made, is permanently unaffected by them. You can forget about clogging of mechanisms due to erosion—about impeded flow due to swollen hose.

If you have a problem in circulating anhydrous fluids, gases, or oils, get acquainted with the long-lasting, low-cost performance of RESISTOFLEX hose assemblies. Write today for details.

RESISTOFLEX CORPORATION

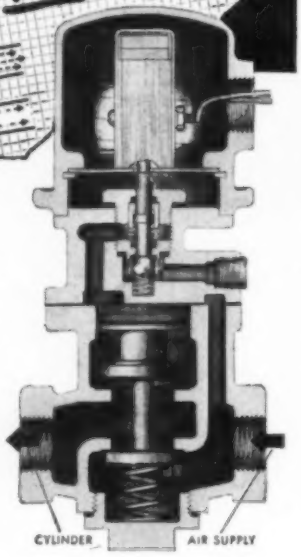
Belleville 9, New Jersey

FLEXIBLE HYDRAULIC, OIL, GAS, VACUUM AND REFRIGERANT LINES. COUPLINGS AND FITTINGS

Install Ross-In-Line for a Full-Flo Line!

THIS

NOT THIS



Solenoid-Pilot Sections interchangeable on all 16 Ross-In-Line Bodies

Full Pipeline Capacity

LOW INITIAL AND OPERATING COSTS

Ross-In-Line valves solve your "on-and-off" problems. Provide instant shut-off, plant-wide or a single coolant line . . . or split-second control of a single acting cylinder. Air controlled, pressures to 125 p.s.i. . . . air, liquid, gas. A better job at lower cost.

Here's Why . . .

• FULL LINE CAPACITY . . . Full pipe size opening through valve. Eliminates pinching, reduces friction loss. • LOW FIRST COST . . . More capacity – thus more efficiency – per dollar. Quick, straight line installation. No brackets. • LOW OPERATING COST . . . Four moving parts, non-corroding. Inspection without removal from line. Solenoid consumes only .2 amp. holding, 1.2 amp. inrush.

Designed and built to *stand up;* Hycar seals, naval brass and stainless steel parts. Specifically for efficient air operated control, straight-way and 3-way, normally open or closed, ⅛" to ¾" pipe capacity.

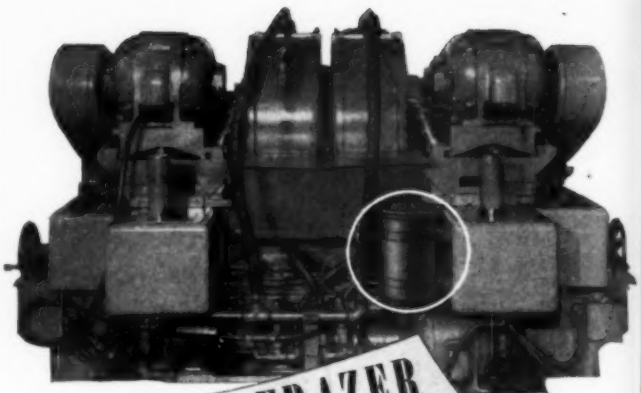
Write for details and name of representative in your area.

ROSS OPERATING VALVE CO.

120 E. Golden Gate Ave., Dept. 190 Detroit 3, Michigan

ROSS

THE BRIDLE FOR A HORSEPOWER



KAISER-FRAZER USES Honan-Crane for Hydraulic Oils

Kaiser-Frazer specifies Honan-Crane for hydraulic oil purification. On this Norton Twin-O-Matic grinder at K-F, Honan-Crane purifier is direct connected to hydraulic oil supply.

Honan-Crane protects precision parts by the removal of pump-damaging, parts-wearing contamination. Oil slippage, power loss and higher operating temperatures result from dirty oil.

For full information on low cost purification and maintenance of hydraulic oils, write to Honan-Crane Corp., 102 Wabash Ave., Lebanon, Indiana, a subsidiary of Houdaille-Hershey Corp.

"M-B" AUTOMATIC Air Line FILTERS and LUBRICATORS

FILTER element removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. LUBRICATOR delivers desired volume of oil, no more, no less. Adjustable Venturi Valve permits efficient operation on broad range of volume and pressure . . . Bowl can be refilled without shutting off air supply. THESE DEVICES CAN BE USED AS SEPARATE UNITS OR IN COMBINATION.

Write for Literature

Representatives in Principal Cities

M-B PRODUCTS

130-134 E. Larned St.
DETROIT 26, MICHIGAN

DIRTY OIL JAMS! WRECKS!

Protect

HYDRAULIC EQUIPMENT

with

MARVEL SYNCLINAL FILTERS

2½ Times More Filtering Area Than Equivalent Size Circular Type Filters

This means maximum filtration in less space. Standard 100 mesh (.0050 opening) insert — others range from coarse 30 mesh to fine 200 mesh inserts. Adaptable to meet any filtering problem.

Sump Type in 6 Capacity Size — 4 Pipe Sizes

— 50, 30, 20, 10, 8, or 5 GAL. per minute. Increased capacity easily obtainable with manifold installations.

Write for Catalog No. 103 containing complete engineering data.

MARVEL ENGINEERING COMPANY

625 W. Jackson Blvd. Dept. 52, Chicago, Illinois

actuates jaw positioning and sheet tensioning cylinders; two systems control the wrap-around motions of the two arms. The latter systems operate at 1000 psi. Because of the size of the machine, a "wing spread" of 33 feet, the nine manual levers for controlling the hydraulic circuits and five groups of push button stations are concentrated in a pedestal at the front of the machine, from which the operator views and controls the entire operation.

The tensioning cylinders are supported in vertical yokes, permitting each cylinder and rod to oscillate in a horizontal plane independently of the arm motion. The tensioning is otherwise fully automatic. Auxiliary hydraulic cylinders rotate and oscillate the jaw assembly. Actual sheet clamping is done by seven pairs of air cylinders which actuate pairs of opposed inserts. The wrap-around motion of each arm is powered by twin hydraulic cylinders—one above, one below each arm, which folds back against the side of the machine frame to produce the wrap-around action. The electrical system, showing tie-in of push button controls, solenoid valves and limit switches, is shown in a work-to diagram.

Aircraft Accessory Systems

T. B. Holliday, *Product Engineering,* v 19, November 1948, pp 119-121.

A comparative analysis of hydraulic, pneumatic and electric solutions to the problems encountered in the design of aircraft accessories with special emphasis on the weight of equipment and devices needed to produce, distribute and utilize power. Limited to accessory systems that draw power from the main engines, the electric generator is compared to the hydraulic pump and the pneumatic pump. For weight of power source the hydraulic pump is better than the generator, less efficient than the pneumatic pump. In distribution systems, electrical systems are considerably better than the hydraulic systems weight-wise, with better performance at low temperatures and with wire having the advantage of greater flexibility over tubing. Pneumatic systems utilizing aluminum tubing for small power tasks, are even lighter than comparable electrical conductors. However, such a system would be quite fragile. Electrical motors are commonly used for conversion to rotary motion; the hydraulic piston for linear actuators. Pneumatic systems may be used for either. While hydraulic systems have had a virtual monopoly for such applications as actuation of landing gear, wing and cowl flaps, electrical manufacturers are showing increasing interest with competitive devices. Combination hydraulic and electrical systems have many advantages, for example, the combination of a constant speed motor and a hydraulic coupling to utilize the advantages of both systems. Also such combinations tend to simplify and streamline hydraulic systems.

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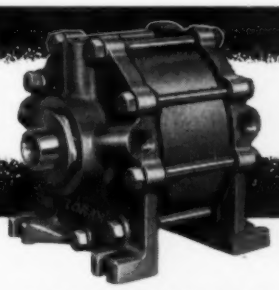

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POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

Hydraulic Equipment Company, manufacturers of industrial hydraulic control equipment, announce the opening of a sales office in the Industrial Office Bldg., 1060 Broad St., Newark, N. J. The office will be under the supervision of Richard Andrews, eastern sales engineer.

The Scovill Manufacturing Co., Inc., has appointed Selden T. Williams, vice president, as general manager of A. Schrader's Son Division. Mr. Williams joined A. Schrader's Son (Incorporated) in 1929.

Raybestos-Manhattan, Inc., has opened a new warehouse and office at 4651 Pacific Blvd., Los Angeles, Calif., to service and stock rubber goods and packings. Schuyler V. V. Hoffman will be in charge.

E. B. Wiggins Oil Tool Co., Inc., Los Angeles, has set up a special equipment division to cooperate with manufacturers in the development of quick disconnect couplings for use with their products. The division will operate under James A. Roberts.

Titeflex, Inc., Newark, N. J., has appointed Manufacturers Sales Agency, 523 Brushton Ave., Pittsburgh 21, Pa., as exclusive agents for Titeflex products in western Pennsylvania and West Virginia. Lewis Detch is manager of the new agency.

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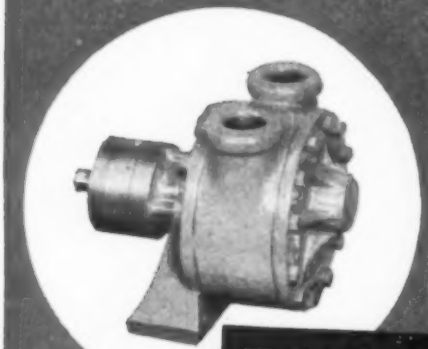

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